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West Lake Landfill
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October 5, 1993

Diana Newman
c/o USEPA Region VII
726 Minnesota Ave
Kansas City, KS 66101

RE: LATA review of West Lake Landfill Workplan

Dear Ms Newman;

This letter accompanies the draft review comments that I have assembled concerning the West Lake Landfill RI/FS. I am sending this same package to Robin Rodriguez at Sverdrup. Ms. Rodriguez may have some questions concerning the text which may require rewrites of some portions.

In general, I felt that the workplan left much to be decided in the field. This may necessitate additional field time by myself or Sverdrup representatives. We can discuss this after you have had a chance to review my comments.

Please call me at 509-783-4369 if you have any questions.

Congratulations on the new little regulator

Yours truly,

Robert Lowy
Senior Engineer

**WEST LAKE LANDFILL RI/FS**
**EVALUATION OF COMMENT RESPONSES**
**RI/FS WORKPLAN**

**WORKPLAN TEXT**

Table 2-1 "Belgian" ore misspelled (as Belgin)

Section 2.3 ref: (Bechtel) should be (Bechtel 1991 ????)

Section 3.2

The authors have selected a 30' x 30' survey grid for the radiometric survey. Text should have been included indicating that survey observations may be collected between grid points for the purpose of defining suspected source areas more accurately.

Fig 3-1 Map legend does not define what the 'approximate limit boundary encompasses. Is this the limit of the regulated landfill or the former quarry?

Fig 3-1 and 3-2

The GB series was deleted but no explanation was provided for the original inclusion. Were these soil borings completed in support of the landfill investigation? Do they provide stratigraphic information that could be of use? Were they "carry-over" from a previous document that were included in the original figures by error?

Table 3-1

The "water-bearing character" of the Meramecian Series (St Louis/Salem Formations) is not completed. As St Louis/Salem limestone is the bedrock on which Site alluvium is founded, these details would be useful.

In addition, as the Warsaw Formation may be an aquitard (stated in section 3.3.2.1). The word "shale" should be provided in the "dominant lithology" column, and "possible aquitard" in the "water-bearing characteristics" column.

Section 3.2.2.1

The text states that alluvial aquifers recharge the bedrock aquifers. This is misleading as it implies that the Ordivician and Cambrian aquifers, in the vicinity of the Site, are recharged directly from the overlying alluvium, which is more than 1000 feet higher in the section. The implication is even more confusing because Table 3-1 indicates that one, and possible two, confining units are contained within this 1000+ section.

The authors should have stated that the deep bedrock aquifers are recharged directly

- by surface water in areas where the bedrock strata are exposed, or

- through the alluvium in areas where truncated limbs of deformed bedrock are disconformably overlain by alluvial aquifers.

The authors should also have noted that the nearest recharge areas lie miles to the east of the Site (I cannot be more precise as I could not locate my personal references that discuss the regional hydrogeology at the time that I prepared this response.

Section 3.3.2.1

The third paragraph states, ...groundwater surface elevations appear to coincide with the Missouri River stage. Was this borne out during recent (summer 1993) flooding? If true, the groundwater table would have been located within the fill materials leading to probable dissolution and remobilization of contaminants. If remobilization has occurred, the data on which the investigation has been formulated may not be accurate.

Table 3-2

The GB series of wells reappear in this table, also. The table indicates the GB locations are shallow borings. Were they completed for the purpose of soil characterization or background studies? Where are they and what significance do they have on this investigation? If none, delete them from the table.

Little is said about fluctuations in the groundwater table caused by local (manmade) influences. Additional information would be useful such as:

- are the stormwater retention ponds lined? If not, why are mounding effects not shown?

- are dewatering wells used to keep the former quarry area dry? If dewatering wells are not used, the groundwater elevations shown in figure 3-10 would drive groundwater into the excavation; I doubt if the (fractured?) limestone would form an effective barrier to over 100 feet of reported hydraulic head. If dewatering is being implemented, why aren't the effects seen in the groundwater contours?

In short, I agree with the observations stated by M&E in comment 20. the groundwater section of the RI workplan has serious shortcomings.

Section 4.3.4

The conceptual model section again refers to "barium sulfate raffinate". Comment 4b observed that the barium sulfate sludge is not raffinate; the author of the response agreed to revise the text accordingly. this was not done here.

The conceptual model section is basically a summary of existing conditions. Conceptual models should note the present conditions and make predictions concerning processes and mechanisms that influence the investigation strategy. This integrated analysis of site conditions is inadequate for planning a comprehensive investigation. This reviewer strongly suggests that the workplan authors prepare another, more exhaustive, version of the conceptual

model section. The guidance provided in the original comment document is adequate for identifying the elements that should be incorporated. Additional observations are provided below.

The conceptual model should build a foundation on which contaminant migration could be inferred:

- Groundwater and soils in the Midwest can exhibit anomalously high radioactivity due to naturally occurring thorium and radium. The workplan should discuss how background conditions and locations will be identified, current background conditions that meet these criteria, needs for additional background sampling, and where background samples might be collected to meet this need.

- The text should describe the contaminants of concern and their migration characteristics (for example, uranium is present and readily forms soluble carbonate complexes under alkaline pH conditions; radioactive daughters of radium include radon gas which can diffuse upwards through the vadose zone to the atmosphere, etc).

- The text should describe transport mechanisms for the contaminants (for example, soluble uranium species carried downward to the water table by surface water infiltration, the presence of interlayered clay strata impede the downward migration of soluble contaminants etc.)

- A discussion of possible migration routes and release mechanisms due to remediation efforts might be useful. Excavation is likely to be undertaken which could lead to airborne releases of radionuclides that are currently stabilized under the existing soil cover.

- Detailed information requested by the M&E commentor were ignored (i.e. aerial photos).

The conceptual model of regional groundwater flow patterns is not convincing. Local flow patterns (Figure 3-11) appear to be towards the northeast (as stated in the comment) and not to the northwest as stated in the text. The response to this comment was unsatisfactory.

- The author claims that the figure was constructed using appropriate methods and never addresses the obvious inconsistency.

- No attempt has been made to introduce groundwater data that show dominant regional trends.

- No attempt has been made to introduce groundwater data that show dominant seasonal trends.

- The local effects of the stormwater retention facility and treatment pond have not been addressed.

- Computer generated models using "time-series average" data may be acceptable for well-characterized sites but in this case, a well-sharpened pencil and professional interpretation may have been more appropriate.

The M&E commentor challenged the description of site soils included in the first version of the workplan. Rather than addressing these comments, the responder simply deleted the offending sentence. Deletion of text does not answer a comment. The responder should have prepared a technical rebuttal or accepted the comment and explained how the sandy nature of site soils effect the conceptual model.

Comment 37c asked for expansion of the text paragraph to address estimation of radiation levels and the effect of radiation daughters on radon emissions. The responder simply deleted the offending sentence without adding meaningful insight to the question of radioactive daughters.

The response to the comment concerning "... soil cover limiting migration..." adds no value to the paragraph. This is one instance where deletion of the offending sentence may have been an improvement.

Section 5.1

RI Objectives should be consolidated to remove redundancy and the following items should be added:

- determine the extent and magnitude of onsite nonradiological contamination in areas other than 1&2
- determine the extent and magnitude of offsite contamination
- identify contaminant migration pathways and barriers
- evaluate the hydrogeologic characteristics of the alluvial and bedrock aquifers
- describe onsite and offsite features (including utilities) that could affect implementation of remedial measures
- describe background soil and groundwater quality
- determine groundwater head distribution and seasonal variations
- determine groundwater conductivity parameters
- develop a conceptual model of groundwater/hydrostratigraphic relationships,
- determine contaminant and groundwater boundary conditions
- characterize the soils beneath and adjacent to the landfill for geotechnical and hydrogeological properties that could affect selection

of a remedial alternative, and

- describe the relationship between groundwater and surface water flow.

Section 5.2.1.3

There is no contingency provided for sampling perched water above clay aquitards, if present.

What criteria will be employed to determine if a lower aquifer well is to receive a 10 foot or a 20 foot screen?

Section 5.2.2

The text states that "actions" will be based on comparison with background conditions. Please define the criteria that will be used to establish "background conditions". The subject of "background conditions" deserves a separate write-up in the workplan.

Section 6.3

Surface water sediment samples are to be collected based on surface water flow patterns at Areas 1 & 2. This appears to be a topic that could have been researched before the workplan was prepared and definitive sites identified.

Table 6-1

The M&E commenter asked for an explanation for inclusion of Ra-228 as a primary radionuclide. Acceptable responses could have been that it is a water quality parameter or a daughter of Th-232, a highly toxic radionuclide.

Instead, the text was changed and Ra-228 was replaced by U-235. This change was not justified nor was the comment answered. Little value will be gained from quantifying U-235.

A better substitution for Ra-228 would be Th-232. Th-232 isotope exhibits more toxic characteristics than Th-230 and Th-232 has been detected in groundwater.

There is no reason to expect that the barium sludge contained Th-232 (Belgian Congo pitchblende contained little natural thorium), however, the RI must eliminate the possibility of cross-contamination from other sources through sampling and analysis. Th-232 may be naturally occurring in the area. This could be proved by comparison with a defensible background analysis, if one were available.

Section 6.4

The use of random selection of soil boreholes implies that the investigation lacks a definitive strategy. A partial list of reasons for selecting a specific site are provided below:

- increase the knowledge of geologic/hydrogeologic conditions,

- infill in areas where basic information is lacking,

- explore continuity of subsurface barriers to contaminant migration, or
- define lateral continuity of known waste disposal source areas.

The text could be improved by identifying areas where data is lacking. The authors could specify a number of borings that will be completed within these areas. The exact sites could later be sited based on radiological surveys or actual field conditions observed as the investigation proceeds.

Section 6.5

A well cluster was to be installed at the east boundary of Area 1. This nest could not be located on the maps provided in the text. Did the authors intend to install the nest on the west side perhaps?
A bedrock well installation closer to S-84/D-85 could be defended as a well cluster for Area 1.

Similarly, the bedrock well north-northwest of Area 2 could be moved closer to S-61 or S-60 to complete a well cluster.

Additional groundwater information is needed between the access road and Area 2. This information could be supplied by installation of two 1" piezometers at relatively small cost. Installation of these piezometers need not be accompanied by stratigraphic logging or sampling.

Section 6.6

Grain-size analysis is a method of determining permeability of the silty clay. If encountered, a silty clay sample could be collected as a core and delivered to a geotechnical testing laboratory for permeameter analysis. This test method is more reliable than grain-size extrapolation.

Section 6.7

One (or more) staff gages were promised for monitoring water levels in the surface water body lying north of the site. Installation of these gages was not included in the SAP. The gage must be fixed to a permanent structure that will not shift or subside. One possibility is a bridge abutment, if present.

All existing groundwater wells should be measured for water levels (at least every 3 months). This would permit better definition of seasonal and local water level variations and verify previous flow models. This simple activity would go a long way towards validating one aspect of site conditions.

Section 6.9

Sampling and associated geotechnical testing to support the berm stability studies are not mentioned in the SAP. Will any be required?

**SAMPLING AND ANALYSIS PLAN**

General

Land Surveys:

What are data quality expectations for locating well elevations, surface samples sites, radiological survey-grid positioning etc.

Well-92:
Downhole geophysical techniques should be employed to determine well construction details (i.e. position/depth of screen and total depth of well.

Wells D-93 and D-94:
Data collected from these wells should be considered questionable for groundwater quality or water level determinations because these wells were not completed properly (no gravel sand in annulus). Data collected from these wells can be used for meeting data quality objectives that do not rely on well completion technique (i.e. stratigraphic information). Quality and elevation data should be compared to data collected from nearby wells for conformance with regional trends before inclusion in remedial investigation reports.

Wells/borings of the EC series:
Wells at Ford EC locations (D-95, EC-8, EC-9, and EC-12) do not appear on site maps.

Surface Radiological Survey

One approach that has not been considered is the use of passive radon gas measurements (charcoal canisters) for identification of hotspots. Radon canisters were used by RMC for air quality and this technology can be adapted to reconnaissance investigations.

The method suggested is to place canisters directly on the ground surface and cover with a coffee can. The coffee can maximizes radon gas collection and eliminates radon gas that might be introduced from the atmosphere.

After 2 weeks the canisters can be collected and analyzed. The analytical results can be used to contour radon gas emissions across the site to identify hotspots. This method is not labor intensive, the canisters are reasonably priced, and the results are indicative of long-term trends, at a reconnaissance-level of data quality.

Newly Constructed Bedrock Wells

Some number of samples from the bedrock formation should be analyzed for the primary radionuclides. This can be accomplished with no increase in the total number of samples. The SAP states that two samples from each alluvial boring will be analyzed for the primary radionuclide suite and up to an additional 5 alluvial samples will be collected for the full organic/inorganic/radiological analytical suite. Why not collect 5 bedrock samples for primary radionuclide analysis from the alluvial borings that are designated to furnish 5 samples for the full analytical suite.

Soil Boring

If fluid is encountered above the silty clay layer in a deep boring, a switch in drilling technology should be considered (to casing hammer drive) to eliminate the possibility of cross-contamination across the aquitard through the borehole.

If perched water is encountered, it should be sampled. The SAP does not address this contingency

Even though this Phase of the investigation is directed toward characterization of radiological contamination, the nonradiological constituents in the alluvial aquifer should be better addressed. The SAP only provides for nonradiological analyses of groundwater samples. A limited number of core/sediment samples should be collected and tested for the presence of heavy metals, pesticide/PCB, and semivolatile organics.

Chemical analyses are to be performed on samples to characterize fill and refuse deposits. However, characterization of fill and refuse will be tricky due to the diversity of materials that will be encountered. The sampling strategy should be described in more detail, possibly in the DQO document. The strategy should discuss the reason for characterizing the refuse/fill and proceed to explain the methodology for:

- recovering a representative sample,
- preparing a homogeneous sample aliquot, and
- identifying the types of chemical analyses that will fill the DQO requirements.

Soil borings (at locations designated by EPA) are to be drilled to depths of 5 feet below the refuse. How will the term "refuse" be defined in the field investigation (what are the diagnostic characteristics of refuse)?

What criteria will be used to determine when clean soil has been encountered and the base of the refuse has been encountered? Clean-looking material could be foundation soils beneath the refuse or a stratified layer within the refuse fill. "Clean soil" should be identified on the basis of specific field parameters or down-hole tests.

How will the base of the landfill be identified if the thickness of refuse is unknown? One suggestion would be to bore until 3 consecutive "spoons" of clean soil are recovered and then submit the first for chemical analyses as representative of landfill foundation soils.

Water Level Measurements

One of the more serious deficiencies of the West Lake Landfill is the conceptual model of groundwater processes. The description of local flow relationships is based on average piezometric conditions; previous commenters have stressed that the use of average values is unacceptable for developing a model of groundwater flow.

This reviewer has similar reservations. Site-wide, static groundwater conditions can only be described by using data that is collected within a short time period by the same team of investigators. In only a few hours of review, I identified numerous inconsistencies in the groundwater model that can only be resolved using accurate and current water level information. For example, a large cross-section of the wells were measured during August 1985. A groundwater

elevation contour map constructed from this data shows the presence of anomalous sinks and mounds that are difficult to resolve with the conceptual model.

All wells should be measured before RI activities disturb existing hydrogeologic conditions. The costs associated with this simple activity are not excessive. Competent professionals could measure the water levels in the existing wells within 1-2 days, using modern transducers and dataloggers. This activity should be repeated after all new wells are completed and stabilized.

The most practical approach would be to collect water level measurements during the field visit to conduct slug tests. Water levels have to be determined for the slug test so that the slug can be carefully introduced into the well. The wells that are not slug tested can be measured for water levels before slug testing commences.

Groundwater Sampling

Groundwater wells, I-67 and MW-F3, exhibited high radiological activity in 1990 (Figure 3-16). These wells should be resampled to confirm the earlier analyses. In addition, existing wells further removed from the landfill and downgradient of the high activity wells should be sampled to establish the lateral extent of contamination. Some attempt should be made to compare these values to background conditions in limiting the lateral extent of contamination.

The use of PVC has questionable advantages. During the reconnaissance phase of investigation, PVC is cost effective. However, if organic contaminants are discovered, it is not likely that the PVC wells can provide long-term defensible samples and stainless steel wells may be required. As long as radionuclides/metals are the primary contaminants, the use of PVC will be acceptable.

No indication as to the joining of the PVC well casing material is provided. Will threaded joints be used? If not, how will the casing be assembled without introducing organic glue into the monitoring system?

The SAP indicates that when penetrating landfill material or installing a bedrock well, a 6 (or 8) inch well casing may be grouted in place and a 6 (or 8) inch borehole drilled below to accommodate a 2 (or 4) inch monitoring well. The 6 (or 8) inch (OD) casing will not provide sufficient clearance for the drill bit. Even if the bit could be fit into the casing, bends and irregularities in the casing would cause "hang-up" areas. It is recommended that the upper casing be stepped using 8 (or 10) inch diameter material to facilitate the installation of the monitoring well.

VOC/Petroleum Product Sampling

Purging the wells before sampling for VOCs or petroleum products could be counterproductive. Consider collecting a bailer sample from 2-4 unpurged, perimeter wells that are immediately downgradient of the landfilled areas and analyze these samples for VOC/TPH. The wells can then be purged and

sampled for other constituents as described in the SAP. The information gained from the "first-bailer" sample would enable the investigators to determine if floating product is present at the water table in areas most likely to have been contaminated by common "industrial" products.

Slug Tests

Indicate that different sized "slugs" will be used to test the 2 inch and 4 inch wells. A slug that is used to induce a meaningful head change in a 2 inch well will not induce a dimensionally similar displacement in a 4 inch well. The most practical solution is to use slugs with different outside radii that can create a 2-3 foot (minimum) head change. The desired head change should be based on aquifer properties and expected response to the introduction of the slug.

The data obtained from the slug tests would be more defensible if the tests are conducted before sampling. Well purging may effect aquifer response to the slug test; these effects cannot be quantified. Unnecessary doubt as to the representativeness of the test could be introduced if anomalous results are observed.

The text does not include a statement that the slugs will be decontaminated. As slugs are not disposable or dedicated tools, they will have to be reused which could introduce cross-contamination between wells (and aquifers).

Geotechnical Testing

The SAP does not discuss the geotechnical testing that will be performed on the silty clay, if encountered. How many test samples will be collected and what are the criteria by which the test samples will be selected.

The workplan discusses collection of silty-clay and grain-size analysis for determination of permeability. Grain-size analysis is not as good as a laboratory permeameter test.

Leachate Seeps

The SAP does not discuss collection of berm seepage as a task. This deficiency is understandable as the authors probably do not believe seepage will be observed and they will not be required to collect a sample.

Unfortunately, this premise probably will be accurate. If seepage is not present, the borehole sampling program should be biased towards collection of radioactive and moist sediments.